Chapter 3

Evaluation Criteria

The Working Group began its deliberations by identifying the criteria it would use in evaluating the suitability of the various solid waste processing and disposal technologies being reviewed for the state of Delaware. Seven criteria, focused on evaluating the technologies with respect to the charge the Governor gave the Working Group, were selected.

These seven criteria, however, do not define all of the considerations that need to be taken into account in making a final decision about what Delaware should do to resolve the solid waste management issues currently facing the state. They do not, for instance, address such key issues as community acceptance, how any facility would be financed, who would own and operate it, the corporate strength and experience of potential technology vendors, and where a facility would be sited. These are issues that the state will have to address through whatever follow-on activities it considers most appropriate.

This chapter discusses the seven criteria and how the Working Group interpreted them.

THE SEVEN CRITERIA

Readiness and Reliability

The first criterion, readiness and reliability, addresses the likely viability of the technological process given Delaware's situation and schedule.

Readiness

The readiness component of this criterion addresses the question of how confident can the state be that if a full size facility were built, it would operate effectively. Technologies that are incorporated in multiple commercial facilities that have been operating successfully over a reasonable period of time received a high rating for readiness; those for which there were only a few commercial facilities that had been operating only a few years were given a lower rating, and those for which no commercial sized facilities had yet been built were given a low rating.

Other factors that might affect the rating of an individual technology include:

- The existence of multiple vendors (the existence of several vendors might suggest that the technology has or is becoming commercial),
- The corporate stability of the vendors (technologies offered by vendors with an established history in solid waste management might suggest a higher degree of readiness),

- Whether the technology has been in use for other purposes for an extended period even if it has not frequently been used to process MSW (technologies that are well tested with other feedstocks might be rated higher), and
- Readiness ratings by other governmental units undertaking evaluations of the suitability of solid waste management processes[1].

To be deemed completely ready for adoption in Delaware, the technology should exhibit all of the following characteristics:

- The technology has been proven to satisfactorily process municipal solid waste at volumes that would meet the anticipated goals of Delaware (i.e. 1,000 tons per day),
  a) The hardware and software associated with the technology is such that replacements parts are essentially "on the shelf" and available
  b) There are sufficient available vendors offering the technology to ensure competitive implementation,
  c) There is sufficient work force available in Delaware and the surrounding region to build and operate the technology, and,
  d) Siting and permitting of the technology does not require a host of special conditions by a permitting and regulatory agency to put the technology on line in a reasonable amount of time.

Reliability

The reliability criterion addresses the question of how reliable is the process likely to be if it is adopted. Processes that have demonstrated a high degree of reliability over a significant period of time in the commercial processing of MSW received a high rating. Those that have been in commercial operation for only a few years, but have demonstrated reasonable reliability during this period, would receive a medium rating. Processes that have experienced frequent upsets or frequent or extended downtime for maintenance received a low rating.

For many of the processes, however, there was insufficient operating experience to determine a rating on this basis. In these cases the Working Group took account of such factors as:

- The Working Group's assessment of the inherent reliability of the process being considered (processes that would appear to be easily upset by changes in the quality or quantity of the feedstock would receive a low rating),
- The demonstrated reliability of the technology in processing other feedstocks (if a technology is unreliable with other feedstocks which are more uniform than MSW, it is unlikely to be reliable in processing the highly variable MSW feedstock),
- If several parallel units would be in operation in a commercial sized facility, this was considered to increase the likely reliability because an upset in one unit would not require the whole operation to be shut down.

[1] See Appendix C for a listing of the studies similar to this Delaware study released by other governmental units.

To be considered completely reliable, the technology should satisfy the following conditions:

a) It is a technology that has successfully demonstrated consistent and dependable operation to handle, treat, or dispose of municipal solid waste (MSW).

b) The technology has operated at designed operating capacities for extended periods of time,[2]

c) The technology would have satisfactorily processed,[3] or could reasonably process municipal solid waste at volumes that would meet the anticipated goals of Delaware (i.e. 1,000 tons per day).

Inputs and Pre-processing

The second criterion focused on what inputs the system would process, and how those inputs had to be pre-processed in order for them to be converted (or disposed of) effectively by the technological process.

Inputs

Each technology was rated according to the types of wastes it had demonstrated an ability to process. The waste stream of interest were:

- Residential wastes
- Municipal Solid Waste (MSW) which includes, in addition to residential wastes, commercial and some industrial wastes
- Sewage sludge from a secondary sewage treatment plant
- Tires
- Yard Wastes (which have traditionally been considered a component of MSW).

Although some processes claimed to be able to process hazardous wastes and medical wastes, these were not included among the inputs of interest. Construction wastes were also not considered.

The more of these inputs the process claimed to be able to handle, the higher the rating it received.

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[2] Normally, solid waste management facilities such as transfer stations, material recovery facilities, and sanitary landfills have two peak periods – usually about 10 AM and 3 PM – when incoming solid waste is at the maximum. Consequently, storage must be able to accommodate these peak periods.

[3] Frequently, facilities such as transfer stations cannot, by regulation, store solid wastes over the weekend if they are not open for business. Facilities that operate on a continuous basis require solid waste storage bunkers that can accommodates three or more days of solid waste to feed the plant over weekends and holidays. In addition, processing facilities should have enough capacity to accommodate planned downtime for maintenance

Pre-processing:

No technology could handle all the wastes without some preprocessing. For most, at the very least, large items such as furniture, large appliances, and other bulky items have to be removed from the waste stream before it enters the process. Because this was a constant across all technological process, it did not affect the ratings.

Thermal processes typically could not accept sewage sludge unless the water content were substantially reduced. They also typically required tires to be shredded before they entered the system.

Biological processes may also require size reduction of materials, and typically can not process tires at all.

One complication in evaluating preprocessing needs was that some of the vendors incorporate the preprocessing requirements in their system while others do not. Yet the preprocessing system is not usually integral to the technology being evaluated. One vendor might propose a highly labor-intensive and apparently complex preprocessing step while another attempts to accomplish the same end with a much simpler and more mechanized system. The Working Group attempted to normalize its evaluations by considering only the amount of preprocessing required without focusing on the specific type of preprocessing that particular vendors might propose. We may not have always been successful in this effort.

The rankings for technological processes were higher for those technologies that do not require substantial preprocessing for the inputs they accepted, and lower for those that do require substantial preprocessing for those inputs.

There is, of course, a tradeoff within this criterion. A technology could be assumed to accept only a few inputs that would require little preprocessing. In this case it would receive a low ranking on the first element of the criterion but a high ranking on the second. However, the same technology might be able to accept a wider range of inputs if they were pre-processed appropriately. In this case the first element would be ranked higher and the second lower. In its overall ranking for this criterion, the Working Group attempted to take both possibilities into account.

Potential Public Health and Nuisance, Environmental, and Worker Safety Risks

The third, and extremely important, criterion focused on the extent to which the technology might present risks to the public, the environment, or workers at the facility.

Public Health and Public Nuisances:

Air emissions, particularly of potentially hazardous substances, constitute the primary risk to public health. Some technologies have a higher potential to generate such emissions that others. A major concern is the propensity of thermal processing systems, under certain conditions, to generate dioxins and furans. These are compounds believed to be highly carcinogenic. Thermal processes can also release vaporized mercury, lead, and other hazardous substances. Modern pollution control equipment, if it is operating properly, has demonstrated substantial success in preventing the release of these substances. However, concerns remain about releases that could occur during upset conditions (including upsets both of the process and of the pollution control equipment) and during periods of start-up and shut down.

Air releases of other “criteria’ pollutants such as particulates, $NO_{x,}$ and volatile organic compounds (VOCs) may also generate public health risks, particularly in a state like Delaware where the ambient air quality can exceed ozone and other air quality standards established to protect public health.

Several of the systems reviewed were “closed” systems that had no direct releases to the air. However, these systems typically generated a gas product for use in electrical generating facilities or as a chemical feedstock. Often the gas products contain hazardous substances, which, if the gasses are not adequately cleaned, would result in indirect releases of these substances creating potential risks to human health. The potential for such indirect releases was considered the same as the potential for direct releases in this evaluation.

The other source of potential risks to public health is the residual materials left over at the end of the processing that have to be disposed of appropriately. In some cases these materials can contain leachable, hazardous substances that can potentially threaten ground water or surface waters. Such residuals may even be characterized as hazardous wastes and require disposal in special landfills constructed for the disposal of hazardous substances.

It is conceivable that there could be other forms of releases creating potential public health risks from MSW processing systems, but none were identified for the processes the Working Group reviewed.

With respect to public nuisance risks, the primary concerns are noise and odors. The most serious odors usually result from anaerobic bacteria releasing hydrogen sulfide as they consume organic materials in the wastes or waste products.

Animal scavengers (rats, feral dogs, raccoons, etc.) can be attracted to raw wastes if they are not managed properly and cause a public nuisance and even risks to pubic health and safety. However, the Working Group assumed that that the wastes would be managed properly and that any waste processing facility would be located in an enclosed building so that the wastes were not available to scavengers. Thus this consideration was not included in the rankings comparing alternative technological processes.

The fewer the potential public health and public nuisance risks that could result from a facility’s operation, the higher the ranking under this element of the criterion. A low ranking could be raised if there was pollution control equipment available that had demonstrated an ability to eliminate both the direct (if necessary) and indirect releases. This was particularly the case if the pollution control equipment has been installed on the technology being reviewed and has clearly demonstrated its ability to control releases to levels substantially below the emission standards established by the US Environmental Protection Agency.

No attempt was made to conduct formal risk assessments for public health or other types of environmental risks because such assessments require knowledge of where a facility will be located and the specific emissions from the facility. The former was not a factor considered by the Working Group, and the latter depends very much on the specific size and nature of the facility being built.

Environmental Risks

Many of the environmental risks coincided with the public health and public nuisance risks and, therefore, were not evaluated independently under this element of the criterion. However, there are certain environmental risks that do not create direct public health risks.

For air emissions, the most significant of these is the release of "greenhouse" gases. These are gasses such as methane and carbon dioxide that, as they accumulate in the atmosphere, accelerate the process of climate change. The higher the propensity of a process to directly or indirectly release such gasses, the lower its ranking according to this element.

Other environmental risks are associated with the consumption of water and the release of contaminated waste waters. The more water a process consumed the lower its ranking under this element. Processes that consumed large amounts of potentially potable water (compared to those that could use saline water) were particularly low.

Two types of waste water were considered in the rankings: waste process water and contaminated storm water runoff. The waste process water could presumably be treated to satisfy environmental quality standards unless it contained contaminants such as salt that are not easily removed from the waste stream.

For storm water runoff, if the process could be located in an enclosed building, as the Working Group recommends, and no wastes or solid products would be stored outside this building, storm water runoff was not considered to be an issue. If such conditions did not pertain, it could be, and the ranking under this element was reduced. If the entire process could not be enclosed, there is also a potential for leachate from rainwater seeping through the wastes (or waste products) contaminating surface or ground waters, and the rating under this element were reduced.

The final major factors considered under environmental risks were the indirect environmental benefits or costs that might be associated with a technological process. For instance, if the process recovers materials such as metals, paper, and plastics for reuse, it reduces the need to produce these materials from virgin materials, an operation that typically involves sometimes substantial environmental damage, pollution, and energy consumption. To the extent that processes produced products that substituted for such virgin material processing, they were credited with indirect environment benefits, although the magnitude of these benefits could only be roughly approximated, and they were unlikely to realized within the state of Delaware. The two major causes of such benefits are the recycling of materials and the production of energy. The more of these indirect benefits associated with a process, the higher its ranking under this element.

Worker Safety

Evaluating the worker safety element of this criterion was a more subjective process than evaluating the other risks, and was given less weight in the overall ranking for this criterion. In general, the more workers appeared to be in direct contact with the waste materials and directly involved in the waste processing, the more the concern for potential worker safety issues. This is particularly true if workers are involved in lifting and moving heavy waste items and picking undesirable items out of the waste stream by hand in the preprocessing stages, or are exposed to the wastes and the waste products during the conversion process.

However, the degree of worker exposure appears to depend more on the specific system being proposed by a vendor than on the technological conversion process itself. Some vendors incorporate a largely mechanized system, providing little direct exposure, which they claim accomplishes results similar to labor intensive systems. If worker safety is a concern, a vendor offering a more mechanized system could be selected. This is the principal reason why this element of the criterion was weighted less heavily than the other elements that evaluate the risks of potential releases inherent to the functioning of the technological process.

Another worker safety issue is associated with possible disruptions to the process, and the potential for such accidents to injure workers. Some processes operate under high temperature and possibly pressure, and piping failures or other similar accidents could expose near-by workers to serious risks. Such a situation would result in the ranking being lowered under this element even if there were no worker exposure under normal operating conditions.

Energy Balance

The fourth criterion relates to the energy balance of the technological process – the comparison between the amount of energy required to operate the process to the amount of usable energy (or the energy value of fuels) that is an output of the process. MSW itself has an energy value depending upon its composition and moisture content.[4] In the Working Group's evaluations it was assumed that typical Delaware MSW had an energy value of 5000 BTUs per pound of waste. Other energy inputs include the energy used in preparing the wastes for processing and the energy consumed by the process itself. All the technologies were assumed to consume the same amount of energy in collecting the MSW and transporting it to the processing site. Thus that energy is not included in the comparisons between the processes.

Evaluating the energy output was more difficult. One process results directly in the production of electricity. In the other processes producing energy, the energy is stored in the form of some sort of (often gaseous) fuel that could be combusted in an electrical generating facility or utilized in some other manner. For the purpose of comparisons, it was assumed that all the fuel would be used to produce electricity in a standard electrical generating facility. A typical electrical generating facility combusts the fuel to produce steam that is then used to drive a turbine and generate electricity. Such a facility can be assumed to have a gross efficiency of

[4] For instance constituents such as plastics and paper have a high energy value for thermal processes, but increased moisture contents reduce the net energy value of the wastes for these processes because the water has to be evaporated. For biological processes, plastics and tires have no energy value, and moisture levels are less important.

slightly more than 40% for converting the fuel to electricity but it requires about 30% of that generated electricity to run the plant, resulting in an overall net efficiency of something a little less than 30%.

The efficiencies could be increased if the waste heat (from both the solid waste conversion process and the electrical generating facility) could be used for local heating needs or some other purpose. However, this is not commonly done in the United States and the potential for such a use would depend upon the specifics of where the facility was sited – a factor not considered by the Working Group. For the comparison of net electricity from an electrical generating facility, using cogeneration would be an option with any of the fuels considered and would increase efficiency the same relative amount with all the technologies considered. Therefore, such possible energy efficiency benefits were not included in these comparisons.

It is also true that some forms of energy are potentially more valuable than others. In particular, two of the technologies produced some of their fuel product in the form of hydrogen, which has a relatively high market value and could well become more valuable in the future if the United States shifts towards a "hydrogen economy". It is also possible that fuel cells could be used to convert hydrogen to electricity at a higher efficiency than assumed in these analyses. At the present time, however, such prospects have not been commercially demonstrated, and thus, in these energy balance evaluations, no added efficiencies were accorded processes producing hydrogen.[5]

The higher the positive energy balance – the percentage that total usable energy outputs are of total energy inputs (including the energy value of the waste stream) – the higher the rating under this criterion. When positive energy balances were essentially the same, those technologies that required less energy inputs were rated higher under this criterion.

Materials Balance

The fifth criterion relates to the materials balance of the process, particularly the amount of the waste stream that is converted into useful products and, therefore, does not have to be disposed of in a landfill.

The conceptual mass balance approach used in this evaluation is depicted in Figure 3.1. For each of the technologies, the Working Group attempted to estimate the amount of materials entering the system, and the amounts exiting the system in various forms (useful products, air emissions, solid residuals, etc.). In terms of the materials balance perspective, the key question was the amount of the material that ended up as residuals compared to the amount of feedstock. The lower this ratio, the higher the rating.

[5] Some consideration was given to the value of this product, particularly for uses other than combusting it in an electrical generating facility, in the economics evaluation discussed below.

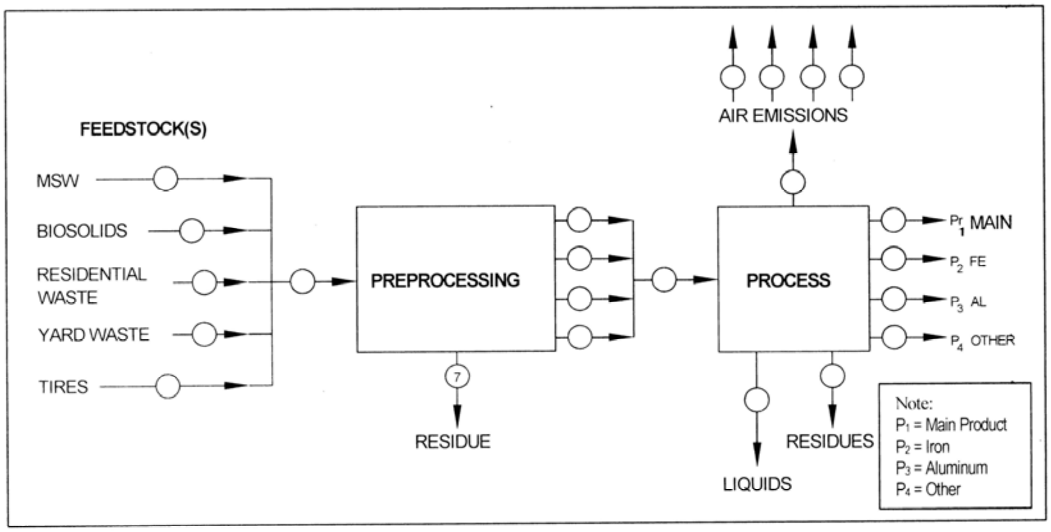

Figure 3.1
Conceptual Basis for Materials Balance Evaluation

The materials balance evaluation also attempted to consider chemical changes taking place in the process, particularly with respect to: a) potentially hazardous substances that might be entering the system and where they ended up or how they were transformed to non-hazardous substances, and b) hazardous substances that might generated by chemical reactions taking place within the system. The feedstocks to the process and the reactions occurring within the process are too complex and variable to allow a complete chemical balance to be defined. However, using principles of chemical engineering and the limited literature studying chemical reactions in such processes, the Working Group attempted to identify what was happening to hazardous compounds entering the system and whether any such compounds were likely to be generated within the process.

Economics

The sixth criterion addresses the costs of building and operating a facility, and the revenues the products of a process might generate.

Costs: On the cost side, the evaluation considered the capital investment required to construct a facility and the operation and maintenance costs involved in operating the facility. The capital costs were annualized using a consistent interest rate (7.5%) and both the annualized capital costs and annual O&M costs were divided by the estimated annual tonnage processed to produce a estimate of the cost per ton of waste processed. Some capital costs, such as the cost of land and site preparation were not included in these calculations because these are very site specific, and, as indicated earlier, the Working Group did not attempt to identify where the facility might be located. The cost estimates were prepared for facilities processing 500 tons a day and 1000 tons a day. In many cases these cost estimates were very approximate and uncertain because no facilities having such capacities have been built in the United States, or the information available to the Working Group was incomplete.

Cost estimates from other studies as well as the experience of Working Group members having substantial experience in the field of solid waste management were used to confirm, supplement, and modify these calculations. However, in many cases they still must be considered very uncertain.

Revenues: For many of the technologies, estimates of the revenues that might be realized from selling the products resulting from the process were even more uncertain than the cost estimates. If the product were electricity, its value could be estimated fairly accurately, and the assumption that all fuels produced by the processes would be used to generate electricity eliminated the need to value these in terms of their specific composition.

In some cases, it could be argued that these estimates substantially understate the value of the fuel products produced. For instance, some of the processes produce hydrogen which, when cleaned of contaminants, is projected to sell for two to seven dollars per kg, equivalent to an energy value of $0.015 to $0.052 per thousand BTUs[6]. Some of the products (particularly methane) might also be sold at a higher price as a feedstock for Delaware's chemical industry than it would bring being combusted in an electrical generating facility.

The value of some of the other products, particularly compost and other "soil enhancement" products, was particularly uncertain. There is currently a very limited market for compost in Delaware. Where more robust markets exist, the wholesale price of compost typically is in the range of fifteen dollars a ton. Whether robust market capable of consuming the substantially increased quantities of compost that would be produced by some of the processes evaluated could be developed in Delaware is unclear.

The primary potential consumers are landscapers and farmers. However, landscapers demand a very high quality product, and some have expressed serious doubts whether Delaware's agricultural community is likely to be a significant consumer of these materials. This uncertainty is particularly true when the compost is made from MSW because such compost may contain contaminants and foreign materials. The most successful composting operations use a relatively restricted feedstock (typically limited to yard wastes and food wastes) and substantially process the finished material. The composting alternatives considered for Delaware did not include such restrictions and additional processing.

For these reasons, the estimates of revenues that would be generated by the various processes are very uncertain. Before any facility is selected, a good market analysis should be conducted to determine what markets currently exist or could be developed for the products the facility would produce.

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[6] This includes the cost of distribution and is based on the information given in: Committee on Alternatives and Strategies for Future Hydrogen Production and Use, National Academy of Engineering, *The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs*, (The National Academies Press, Washington, DC, 2004), p. 51

Legal and Policy Issues

The Working Group's main focus was an evaluation of the technical strengths and weaknesses of various potential technologies for solid waste management. The Working Group did not attempt to comprehensively evaluate Delaware's solid waste policies and the administrative framework in which those policies are implemented. A main goal of the Working Group was to provide technical information to assist in any subsequent policy evaluation process.

The Working Group did undertake, however, to identify significant current legal constraints that might impact the feasibility of the various technologies. The more such legal inhibitions might be expected to occur, the lower the ranking given to the technology under this criterion. The Working Group also undertook to at least identify in broad terms those policy issues that might be implicated by particular technologies.

Legal Constraints

For any technology ultimately constructed in Delaware, local, state and federal laws and regulations would impose significant restrictions. Local zoning controls would impact siting issues, and would contribute to limiting the localized noise, odor, dust and other impacts of any such facility. State and federal environmental laws would impose a variety of permitting obligations and operational restrictions. DNREC would impose significant operational restrictions through its "Regulations Governing Solid Waste," the regulations under which it enforces the federal Resource Conservation and Recovery Act. The operational restrictions imposed by DNREC will also aim to mitigate or eliminate any noise, odor, emission or other impacts from the facility. Those facilities that might generate air emissions will also have to undergo an intensive DNREC permitting process to comply with the federal Clean Air Act. The most significant hurdle any such facility would face results from Delaware being in a non-attainment region under the federal Clean Air Act for two ambient air pollutants, ozone and for particulate matter (PM 2.5), both of which might be emitted by some of the technologies evaluated.[7]

At the state level, in addition to pollution control regulations, there are two major statutes that might also be implicated in any process for the siting of a new facility. One is the Delaware Coastal Zone Act, and the other is S.B. 280.

Coastal Zone Act: Enacted in 1971, the Delaware Coastal Zone Act serves to protect Delaware's coastline.[8] The Act imposes a ban upon "heavy industry" in the coastal zone. Because the coastal zone, as defined, extends several miles inland in many parts of the state, the development restrictions encompassed in the statute could limit siting determinations for any new solid waste facility. The Act and the regulations under it do contemplate that a "recycling plant" may be a permissible use within the coastal zone, with a permit.[9] The Act specifies that an incinerator is not to be considered a "recycling plant" and further specifies, "An incinerator

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[7] None of the processes emit ozone directly, but some release the gasses that react to form ozone.
[8] 7 *Del. C.* § 7001 *et seq.*, the area included in the coastal zone is defined at 7 *Del. C.* § 7002(a).
[9] *See* 7 *Del. C.* § 7003; Regulations Governing Delaware's Coastal Zone, Section F.2.

structure of facility which, including the incinerator, contains 5,000 square feet or more, whether public or private, is 'heavy industry' for purposes of this chapter."[10]

S.B. 280: In 2000, the Delaware legislature enacted "An Act to Amend Title 7 of the Delaware Code Relating to Incinerators." Known as S.B. 280, the act prohibits the construction of incinerators outside of an industrial zoned area, and also within any area that is within 3 miles of a school, church or residence.[11] The DSWA has indicated that it would require approximately 25 acres to site a waste to energy facility which clearly falls within the definition of an incinerator in S.B. 280. Although no formal study has been undertaken of the matter, the restrictions imposed by S.B. 280 on any future incineration facility in the state appear to render the siting of such a facility all but impossible.[12] If these state requirements were to inhibit the construction of a recommended new MSW processing facility, they could, of course, be amended to allow such a facility. However, the difficulty that would likely associated with any attempt to amend existing laws was taken into account under this criterion.

Policy Issues

The Working Group considered certain policy issues, but the impact of such issues on the rankings was limited. Other criteria evaluated, such as energy balance and economics, clearly implicate policy issues, and the rankings of processes under those criteria implicitly incorporate some policy considerations. The legal and policy ranking focused more on specific legal constraints of particular technologies, with only limited consideration of "policy issues." One reason for this is that certain policy issues, such as flow control, impact all of the technologies equally. Other policy issues, such as public acceptance, were not within the purview of the Working Group and should, as indicated earlier, be addressed in other forums. This section discusses generally those policy issues that were identified and discussed by the Working Group even though they did not affect the legal and policy ratings.

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[10] *See* 7 *Del. C.* § 7003; *see also* 7 *Del. C.* § 7002(e)

[11] S.B. 280 was codified at 7 *Del. C.* § 6003. Subsection c of that provision states, in part, that:

(1) No permit may be grated unless the county or municipality having jurisdiction has first approved the activity by zoning procedures provided by law; and

(2) No permit may be granted to any incinerator unless:
  a. The property on which the incinerator is or would be located is within an area which is zoned for heavy industrial activity and shall be subject to such process rules, regulations or ordinances as the county, municipality or other government entity shall require by law, such as a conditional use, so that conditions may be applied regarding the health, safety and welfare of the citizens within the jurisdiction; and
  b. Every point on the property boundary line of the property on which the incinerator is or would be located is:
    1. At least 3 miles from every point on the property boundary line of any residence;
    2. At least 3 miles from every point on the property boundary line of any residential community; and
    3. At least 3 miles from every point on the property boundary line of any church, school, park, or hospital.

[12] *See* McCabe, *Municipal Solid Waste Landfill Capacity in Delaware* at 56.

Flow Control: A central concern with any party contemplating the construction of a municipal solid waste processing facility is whether there is a sufficient volume of waste requiring processing to generate revenues sufficient to cover the costs of building and operating the facility, and whether the market is sufficiently stable to ensure that those revenues will continue to flow into the facility over its useful life. A common temptation for governments involved in municipal solid waste planning is to ensure the future viability of a particular facility by restricting the flow of wastes out of its service area. If done appropriately, flow control can ensure the viability of major new facilities.

The waste generated in Delaware is only a small part of the solid waste generated in the larger regional area, and that area is serviced by a wide variety of facilities, including large, regional landfills operating in Pennsylvania, Virginia and elsewhere that provide relatively low cost disposal options.[13] The risk of becoming a full participant in the larger regional waste market, and relying upon out of state facilities for a significant portion of future capacity needs, is that the state would then be fully exposed to the vagaries of that market, with no in-state alternative to turn to should other states attempt to limit the importation of wastes or out-of-state disposal fees become unreasonable.

The Delaware Solid Waste Authority was established with jurisdiction over all the solid waste generated in Delaware, and, as indicated in Chapter 1, it adopted a policy that it would process or dispose of these wastes within the state. Although this policy was adopted by the DSWA Board of Directors, and, therefore, has no force outside the DSWA, it is a policy that is in keeping with the state's intent in establishing the DSWA. Many consider it a reasonable policy for any of several reasons: a) it protects Delaware from restrictions and requirements imposed by governments outside Delaware; b) it protects Delaware residents from the vicissitudes resulting from changes in prices and capacity in the MSW processing market in this region; and c) it adheres to the principle that people should be responsible for their own wastes.

However, there are limitations upon the ability of governments to utilize flow control techniques in the management of hazardous waste. In the Carbone decision, the United States Supreme Court struck down a flow control ordinance that required all MSW generated within a particular locality to pass through a specified (and privately operated) transfer station.[14] The Court determined that flow control ordinances that discriminate against interstate commerce violate the Commerce Clause of the United States Constitution.

After *Carbone*, the ability of a government to ensure the viability of a privately-run municipal solid waste facility through flow control ordinances appears to be very limited. This does not mean, however, that in the wake of *Carbone* a government is entirely unable to utilize flow control techniques. It should be possible for governments to direct that all waste within a given geographic area be directed a specific facility where that facility itself is also run by the government.[15]

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[13] Indeed, making use of these facilities is one of the options Delaware should consider.

[14] *C&A Carbone v. Town of Clarkstown*, 511 U.S. 383 (1994).

[15] *See United Haulers Ass'n, Inc. v. Oneida-Herkimer Solid Waste Management Auth.*, 438 F.3d 150, 159-60 (2nd Cir. 2006).

Any strategy for meeting Delaware's overall solid waste needs should aim to maximize the ability of the state to utilize legitimate flow control techniques consistent with the limitations placed upon such techniques by the courts.

Community Acceptance: A second policy issue relates to potential community opposition to a technological process. As indicated earlier, the Working Group did not attempt in any structured manner to assess the likely community acceptance of the technologies being considered. But it was aware of opposition to certain types of technologies, particularly because of concern about their potential emissions or odors they might generate. The most vocal concern relates to Waste-to-Energy facilities, because incinerators have, in the past, been a significant source of hazardous air emissions. This concern appears to apply to other thermal processing technologies that are perceived as being similar to "incinerators" even though all the technologies the Working Group considered exceeded current emission limitations. These potential community concerns could inhibit the construction of a new facility and the Working Group, to some degree, took them into account under this criterion, giving lower rankings to technologies that appeared likely to illicit such concerns. The fact that the Working Group took potential community concerns into consideration in no way obviates the need for the state to obtain structured community involvement in the final decision about how Delaware should proceed, and to inform the potentially affected communities about the risks and benefits of any technology that is proposed.

Application of Criteria

On the basis of presentations made to the Working Group, analyses conducted by others, and the personal experience and knowledge of its members, the Working Group evaluated each of the technological processes according to each of the seven criteria. These evaluations are presented in chapter 3. After completing the substantive evaluation, each technology was assigned a summary score on a scale of 1 to 10 indicating how the technology appeared to rank according to the criterion. These summary scores are only a short hand representation of the working group's judgment, providing an indication of how the technologies appeared to rank with respect to one another. A ranking of eight, for instance, does not indicate that a technology is twice as good a one that receives a ranking of 4, only that it is significantly better according to the particular criterion.

Nor should the rankings be added to produce an overall ranking for the technology. To do so implicitly assumes that all of the criteria are equally important. This is definitely not correct. Some of the criteria such as readiness and reliability and potential human health, environmental, and worker safety risks are clearly more important than others.